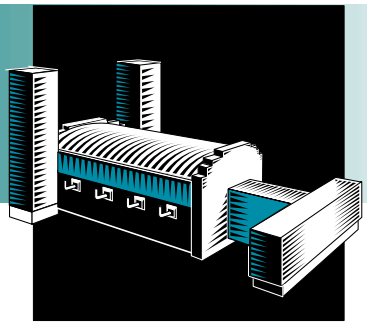
GLASS
Project Fact Sheet



Diagnostics and Modeling of High-Temperature Corrosion of Superstructure Refractories in Oxyfuel Glass Furnaces

Benefits

- Reduced production costs, since less corrosive refractories will lower the frequency of furnace rebuilds
- Reduced emissions through increased industry conversion to a more cost-effective oxyfuel process. Oxyfuel conversion can reduce NOx emissions from a typical float glass plant from over 320 kg/hr to approximately 40 kg/hr
- Improved energy efficiency and product quality by reducing defects—defects resulting from corrosion byproducts dripping onto the glass surface currently cause a 2 percent reduction in yield, and total energy loss for the entire U.S. glass industry due to defects is approximately 6 x 10^{12} Btu/yr

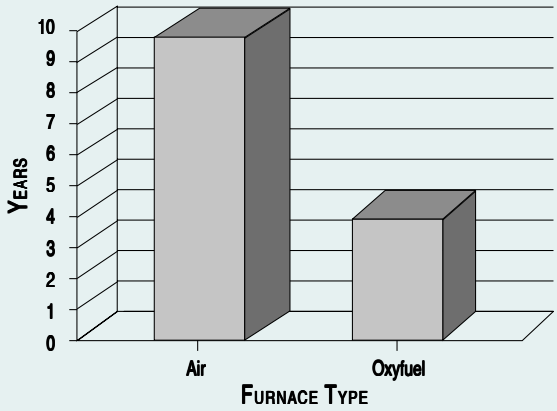
Applications

The mathematical models created can be used by process designers, material engineers, and manufacturers in all segments of the glass industry not only to optimize the oxyfuel process in existing furnaces and retrofits but also to design new ones.

Extended superstructure refractory life will enhance oxyfuel firing process

Oxyfuel firing is rapidly becoming an energy-efficient and environmentally sound alternative to air combustion in the glass industry. However, because of higher temperatures and production of alkali vapors, refractories corrode significantly faster in oxyfuel furnaces; furnace crown life can be shortened by a factor of two to three. The project partners will determine corrosion factors and develop mathematical models that can predict corrosion rates, identify operating conditions that minimize corrosion, and define the attributes of improved refractories for oxyfuel firing. The researchers will also seek to develop optical techniques for monitoring gas-phase alkali concentrations in the melter headspace. Improving the oxyfuel process by extending furnace life will increase the cost-effectiveness of the process and make conversion more appealing to the glass industry.

Current Average Furnace Life Based on Corrosion of Refractory Structures



Technology that improves refractory corrosion resistance will increase furnace longevity, making oxyfuel firing more cost-effective.

Project Description

Goal: Characterize silica refractory corrosion processes in oxyfuel furnaces and use those characterizations to develop models that predict corrosion rates and define attributes of improved refractories. Increasing refractory life will further enhance the oxyfuel process.

During the experimental and diagnostic development phase of the project, the researchers will investigate the factors that contribute to the corrosion rates, particularly gas-alkali species (e.g., sodium hydroxide, potassium hydroxide), which are the most damaging compounds that attack the refractory. High concentrations of water vapor also produce increased amounts of damaging alkali. These higher concentrations of both alkali compounds and water vapor occur in oxyfuel furnaces as a result of the elimination of nitrogen from the input gases.

Once the corrosion data is gathered, mathematical models and on-line diagnostics will be developed that use the data to identify furnace conditions and/or refractory compositions that lower corrosion rates.

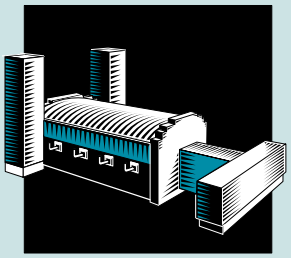
Progress and Milestones

The experimental and diagnostic development phase of the project will be conducted in 1999 and will include the following activities:

1. Characterizing new and used silica refractories

2. Conducting iso-thermal corrosion simulations

3. Measuring alkali concentrations.



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